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(71) Applicant *(for all designated States except US)*: D.S.P. TECHNOLOGY HOLDINGS LTD. [CY/CY]; 15 Them Dervis Street, Margarita House, Nicosia (CY).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: TYREN, Carl [SE/FR]; 12, boulevard Albert-1er, F-06600 Antibes (FR).

(74) Agents: STRÖM, Tore et al.; Ström & Gulliksson AB, Box 4188, S-203 13 Malmö (SE).

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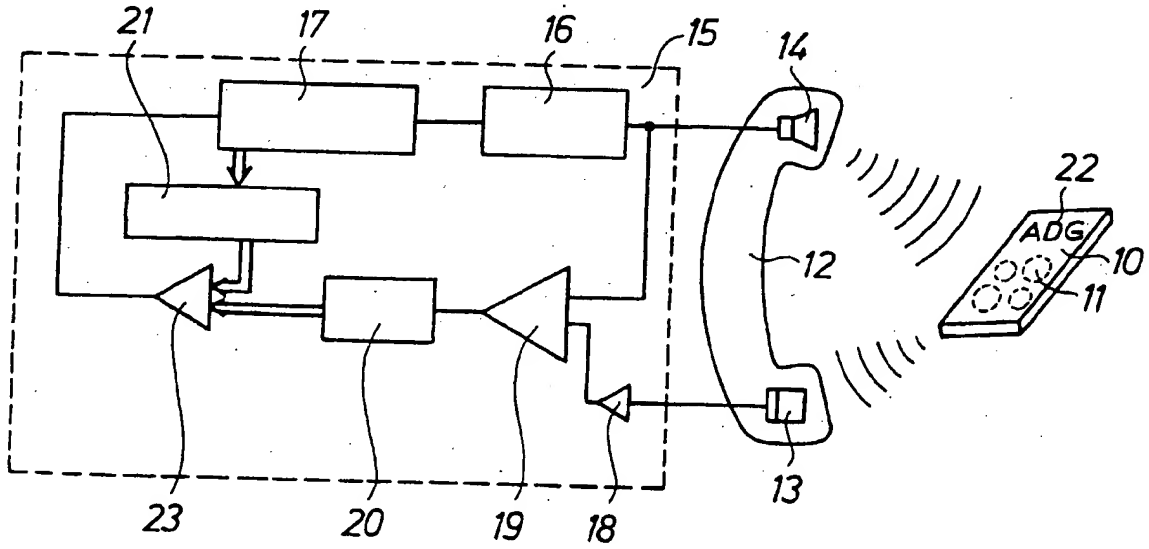
(54) Title: ACOUSTIC IDENTIFICATION OF OBJECTS



(57) Abstract

Method and device for identifying objects by an acoustic transfer of information, acoustic signals being transferred from a loudspeaker (14) to said object and from said object to a microphone (13). Energy of said acoustic signals from said loudspeaker is affected by a set of acoustic means of said object, different objects having different sets of acoustic means (11) identifying said objects. Said acoustic means are formed as oscillating means oscillating at different frequencies during emission of acoustic signals to said microphone, or as attenuating means. The frequencies of said acoustic signals affected by said acoustic means are recorded and combined to a first code in a control unit (15) operatively connected to said microphone and said loudspeaker, said control unit including recording means for recording said acoustic signals, and processing means for combining said acoustic signals to said first code.

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TITLE: ACOUSTIC IDENTIFICATION OF OBJECTS.

Technical field

When telephones are used for purchasing it has more recently become normal to utilize credit cards and similar devices. Normally the purchaser only has to specify a code that is visually readable on the card. This is the case for instance with so called telephone cards used to delay the debiting of telephone calls to the recorded owner of the card.

Prior Art

WO 92/20048 discloses a credit card type device including a microphone, a loudspeaker, and a control unit. The device can be disposed in front of a conventional telephone, and data can be exchanged between said control unit and a computer unit connected to the telephone line through said microphone and said loudspeaker. The control unit is a solid state type unit and an electric power supply is required.

The device disclosed in WO 92/20048 differs in many aspects from conventional credt cards, in price as well as in other areas. For instance there is required a battery or similar device. In some more simple applications it is desirable to ensure through a telephone line that the credit card is indeed available to a person having access to a code visiable on the card and further that the card is physically present during the telephone call.

Summary of the invention

An object of the present invention is to overcome the problems mentioned above with respect to high costs and specific operating conditions, and to provide a cheap card, the physical availability and presence during the telephone call definitely being determined through the telephone line.

The object is achieved by providing the card with oscillating means or sound attenuating means, the characteristic frequencies thereof defining an identity of the card. Further objects and advantages of the invention will be apparent from the following description, and accompanying drawings and claims.

Brief description of the drawings

The invention will be described in more detail by means of a preferred embodiment, reference being made to the accompanying drawings.

FIG 1 is a schematic general view showing a device according to the invention,
FIG 2A is a plan view from above showing a card according to the invention,
FIG 2B is a cross sectional view from line II-II in FIG 2A,
FIG 3 is a general partial cross sectional view of a card according to the invention,
FIG 4 is a partial cross sectional view of a card according to an alternative embodiment,
FIG 5 is a partial cross sectional view of a further embodiment of the invention,
FIG 6 is partial cross sectional view of a card according to the invention,

FIG 7 is a cross sectional view of still a further embodiment of a card according to the invention,
FIG 8 is a schematic perspective view of an alternative embodiment of a card according to the invention,
FIG 9 is a plan view of an alternative embodiment of a card according to the invention,
FIG 10-12 are partial cross sectional views of cards according to alternative embodiments of the invention.

Detailed description of a preferred embodiment

The device according to FIG 1 comprises an object formed as a credit card 10. Said card 10 is provided with a set of oscillating means 11, which after supply of acoustic energy oscillates during emission of acoustic signals of different frequencies. To excite said oscillating means into resonance and to register the acoustic signals emitted thereby the card is disposed in the vicinity of a more or less conventional type telephone 12. Said telephone includes a microphone 13 and a loudspeaker 14. Said loudspeaker 14 and said microphone 13 can be formed in different ways, for instance as dynamical means or piezo electric means. Different telephone systems having different specifications can be used because the device operates completely on an acoustic basis. No other requirements exist than those for voice transfer.

The telephone 12 is connected to a control unit 15 through a conventional telephone line for generating signals and exciting said oscillating means and for receiving and interpreting of the acoustic signals generated by said oscillating means. Said control unit 15 includes an oscillator 16, the frequency and amplitude thereof controlled by a central unit 17 operatively connected to said oscillator.

The electrical signals generated by the microphone 13 are directed to a signal comparator 19 through an amplifier 18, a second input of said comparator receiving the signal generated by said oscillator 16. An output of said signal comparator 19 is connected to a signal decoder 20 transforming a received signal to a first code which is related directly to the current set of oscillating means 11 of the card 10. Said control unit 15 also comprises memory means 21 storing codes corresponding to the code related to the oscillating means, and also a second type of code, which is related to a second code 22 that can be visuably read. In some applications it is appropriate to omit said second code 22. In such cases the identity of the card resides in said first code.

When a card is to be identified there is established a contact between said telephone 12 and said control unit 15. Then the card is disposed between said loudspeaker and said microphone, and a signal is generated by said oscillator 16. The signal generated by said oscillator 16 is transformed in said loudspeaker 14 to an acoustic signal exciting said oscillating means 11 into oscillation. The signal that is used to excite said oscillating means may for instance be an acoustic sweep over an appropriate frequency interval. A second alternative is to transmit a short pulse including a wide spectrum noise.

The acoustic signal generated by said oscillating means 11 is picked up by said microphone 13 which also transforms said acoustic signal to an electric signal. Said electric signal is transferred through said telephone line to said control unit 15 where it is amplified in said amplifier 18. From said amplifier 18

said signal is fed to said signal comparator 19 and the result of from a signal comparation is directed from an output of said signal comparator to to said decoder 20, a complete code corresponding to the set of oscillating means 11 then appearing on an output thereof. Then said visuably readable second code 22 is transferred to said control unit 15 through said microphone 16 or by other means. Said memory unit 21 comprises combinations of said first code and said second code and after receiving said second code 22 the corresponding first code is read from said memory unit 21. An output of said signal decoder 20 is connected to a first input of a code comparator 23. An output of said memory unit 21 is operatively connected to a second input of said code comparator 23 so as to allow a comparison between said received code and the code stored in said memory unit 21. In case of correspondance there between the identity of the card is confirmed. In other words, it can be ensured that the specific card, the second code 22 thereof being directed to the control unit 15, was indeed physically located at the telephone 12.

FIG 2A and FIG 2B show a preferred embodiment of the card according to the invention. Said oscillating means 11 are formed by thin membranes 24 defining cavities 25.

FIG 3 and 4 show alternative embodiments having open cavities.

In FIG 5 it is shown how it is possible by means of a weight 26 to affect the resonance frequency of said membrane 24. Since the resonance frequency of the membrane is determined by the area or diameter, the thickness, the material (E-module, density) and the mass

of said membrane an added extra body 26 may affect the resonance frequency in a desired manner.

FIG 6 shows an embodiment according to which said membrane 24 is formed to have recesses so as to provide a desired resonance frequency of the oscillating means.

It is possible to produce the membranes from other materials than the card it self. FIG 7 shows such an embodiment according to which a membrane made from metal is embedded in the card.

A completely different embodiment is shown i FIG 8. In that embodiment said cavities are formed as cuts corresponding to organ pipes. The resonance frequency is determined by the lenght of the pipes or cuts. Preferably a thin membrane is arranged over the opening of the cuts so as to avoid that the opening is filled.

FIG 9 shows a still further alternative embodiment having a larger circular cavity which is connected to the environment through a smaller channel 27.

FIG's 10 and 11 show embodiments utilizing a type of resonance tongues 28. In the embodiment according to FIG 11 said tongue hits a shorter wall while vibrating, which will result in a characteristic "jingling" sound.

Finally, FIG 12 shows an embodiment having a completely free membrane, for instance formed as metal plate. During acoustic excitation of the membrane the body will "jitter" and generate a characteristic "jingling" sound.

In an embodiment not shown the oscillating means is formed as a first piezo crystal for receiving acoustic

energy and generating an electric signal. Said electric signal is frequency transformed and is supplied to a second piezoelectric crystal emitting acoustic energy in the same way as the oscillating means described above.

Within the scope of the invention it is possible also to arrange said oscillating means differently, for instance such that the used membranes cover parts of a cavity or can be moved otherwise. It is possible also to store and transfer information in other ways than what has been described above. The embodiments described above and shown in the drawings form suitable embodiments but are not to be limiting over the following claims.

According to an alternative embodiment of the invention acoustic attenuating means 11 are used instead of oscillating means, that is means that attenuates sound waves in different ways. Said attenuating means are arranged, as are said oscillating means, within or on said card 10, and different attenuating means have different characteristic frequencies. At said characteristic frequencies the sound is attenuted more than at other frequencies. A card formed accordingly is used in the same way as described above, and is disposed during use between the microphone and the loudspeaker. Electric signals of different frequencies are generated in the control unit 15, also different types of noise can be used, and signals are transmitted to the loudspeaker 14 in which they are transformed to acoustic signals or sound waves. When said sound waves pass said card 10 having attenuating means 11 some frequencies are attenuated more than others. The frequencies of attenuation can be detected in the control unit 15 after the transformation from sound waves to electric signals in said microphone.

Said card 10 comprises a set of attenuating means having characteristic frequencies identifying the card. To avoid disturbances from the surroundings signals having specific frequencies are preferably transmitted from the control unit through the loudspeaker to the microphone and further on to the control unit where they are analyzed so as to obtain information about the characteristics of ambient conditions of the telephone.

Said attenuating means are preferably made from sound damping material having a high level of absorption of sound, for instance cloth or fiber material. It is also possible to form cavities so as to provide sound attenuation at certain frequencies.

The anlysis of the signals received in said control unit 15 can be made in different ways. In a preferred embodiment a simple frequency analysis is made and any present frequencies of the signals are recorded. It is also possible to utilize during the analysis the very distinctive phase shift that occurs when an oscillating means will come into self-oscillation. The phase shift occurs between the exciting signal and the detected signal. However, the signal processing can be made more extensive and complex so as to analyze very complicated frequency responses.

CLAIMS

1. Method for identifying objects (10) by acoustic transfer of information, acoustic signals being transferred from a loudspeaker (14) to said object and from said object to a microphone (13),
c h a r a c t e r i s e d in
that a set of acoustic means (11) that is distinctive to the object (10) and provided on said object (10) affects said acoustic signals,
that different acoustic means (11) affect said acoustic signals at different distinctive frequencies,
that said acoustic signals are picked up by by said microphone (13) and transformed therein into received electric signals, and
that said received electric signals are anlyzed so as to identify said set of acoustic means (11) and thereby said object (10).

2. Method according to claim 1,
c h a r a c t e r i s e d in
that energy of said acoustic signals from said loudspeaker generates a mechanical oscillation of a set of oscillating means of said object, different objects having different sets of oscillating means for identifying said objects,
that said oscillating means are made to oscillate at different frequencies while emitting acoustic signals to said microphone, and
that said frequencies of the acoustic signals generated by said oscillating means are recorded and processed into a first code.

3. Method according to claim 1,
c h a r a c t e r i s e d in
that said oscillating means are made to oscillate at mechanical self-oscillation frequencies.

4. Method according to claim 2,
c h a r a c t e r i s e d in
that said object is identified by a visually readable second code,
that said first and said second code are compared, and
that an acceptance signal is generated, if said first code is related to said second code in a predermined way.

5. Method according to claim 4,
c h a r a c t e r i s e d in
that said second code is supplied to said microphone by voice control.

6. Method according to claim 1,
c h a r a c t e r i s e d in
that said acoustic means (11) attenuates said acoustic signals distinctively to each acoustic means.

7. Method according to claim 1,
c h a r a c t e r i s e d in
that a reference signal is transmitted from said loudspeaker (14) to said microphone (13) for obtaining ambient characteristics of the object (10).

8. Device for identifying objects (10) by acoustic transfer of information, comprising an acoustic communicating means (12) having a microphone (13) and a loudspeaker (14) for transferring acoustic signals between said object and said microphone and said loudspeaker, c h a r a c t e r i s e d in
that said object is provided with a set of acoustic means (11) affecting said acoustic signals at different frequencies,
that said microphone (13) and loudspeaker (14) are operatively connected to a control unit (15) comprising recording means (19) for recording said

acoustic signals, and processing means (20) for combining said acoustic signals to a first code.

9. Device according to claim 8,
characterised in
that said acoustic means (11) are formed as oscillating means oscillating when provided with acoustic energy while emitting acoustic signals at different frequencies.

10. Device according to claim 9,
characterised in
that said oscillating means (11) are provided as acoustic resonance cavities which are excited to self-resonance by signals from said loudspeaker.

11. Device according to claim 9,
characterised in
that each resonance cavity of an object has a specific resonance frequency, a specific set of oscillating means corresponding to said first code.

12. Device according to claim 10,
characterised in
that a membrane having a membrane surface (24) covers a section of at least one resonance cavity (25).

13. Device according to claim 10,
characterised in
that said resonance cavities are provided as channels in said object, said channels being acoustically connected to the surroundings and mechanically closed from the surroundings.

14. Device according to claim 13,
characterised in
that the speed of sound is different in each of said channels.

15. Device according to claim 10,
characterised in

that said control unit (15) comprises transmitting means (16) for transmitting a signal exciting said oscillating means, receiving means (18) for receiving signals picked up by said microphone, memory means (21) for storing said first code and said second code, and comparing means (23) for comparing codes received through said receiving means (18) with codes stored in said memory means.

16. Device according to claim 12,
characterised in
that said membrane surface (24) is provided with different masses (26) for providing said oscillating means (11) with different resonant frequencies.

17. Device according to claim 12,
characterised in
that said membrane is made from another material than said object.

18. Device according to claim 10,
characterised in
that said resonance cavities (25) are formed as elongated dead holes, and
that the opening of the dead holes are covered by a membrane.

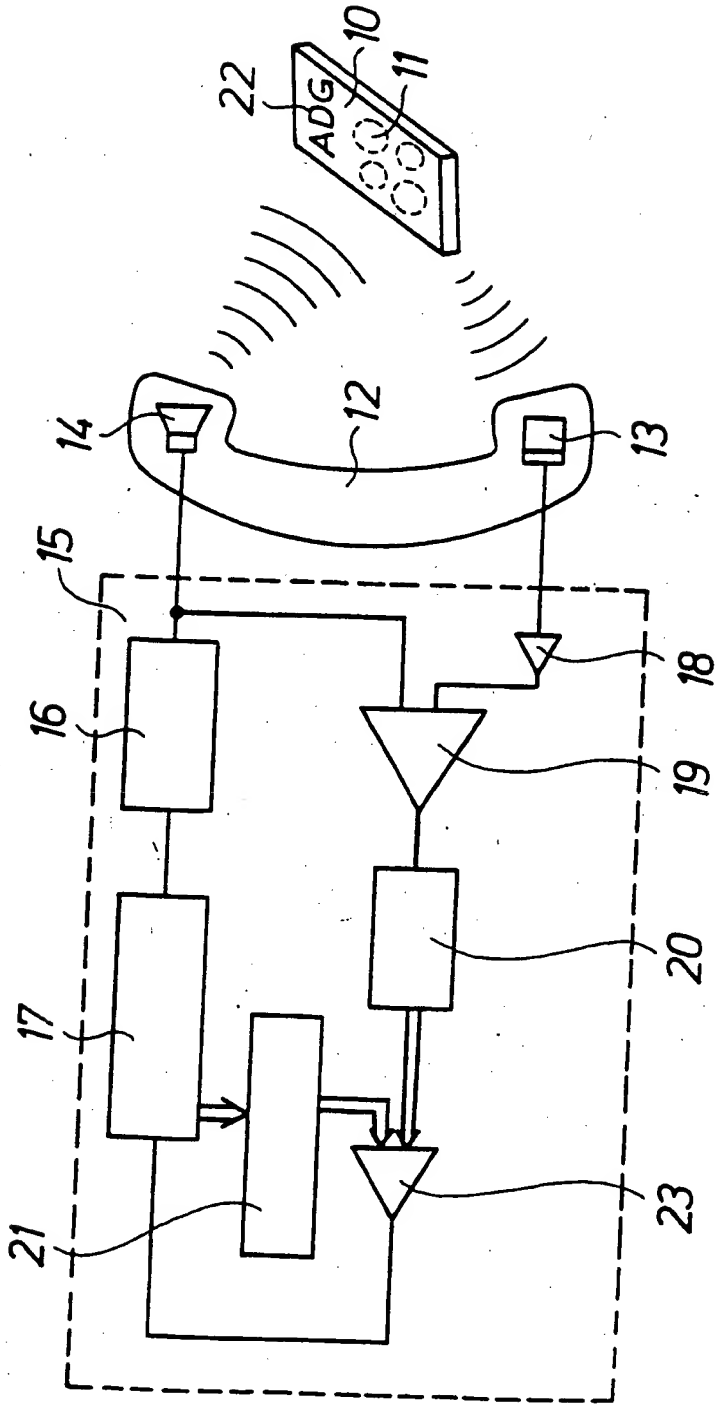

FIG. 1

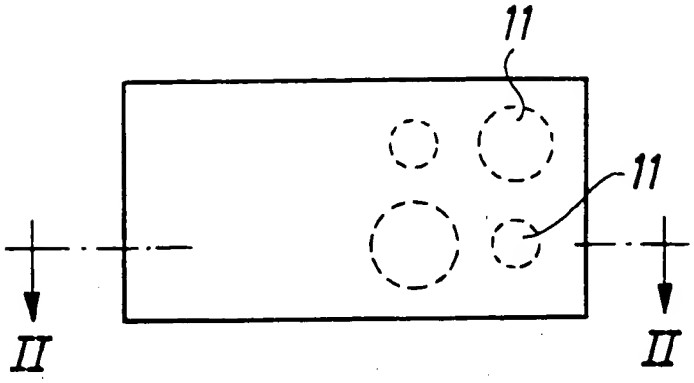

FIG. 2A

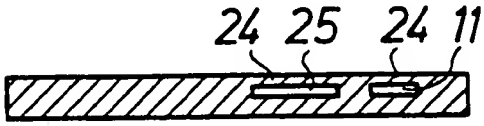

FIG. 2B

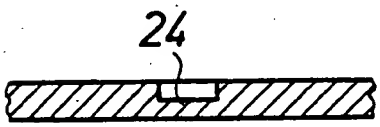

FIG. 3

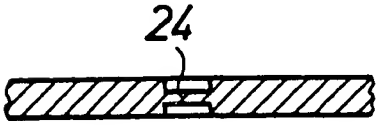

FIG. 4

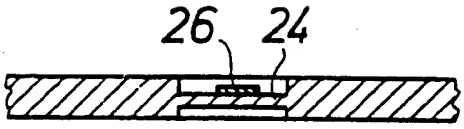

FIG. 5

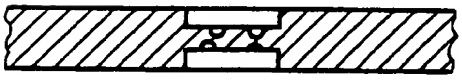

FIG. 6

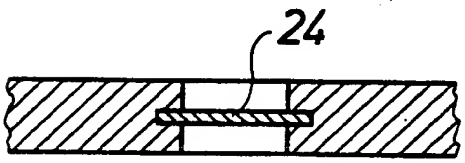

FIG. 7

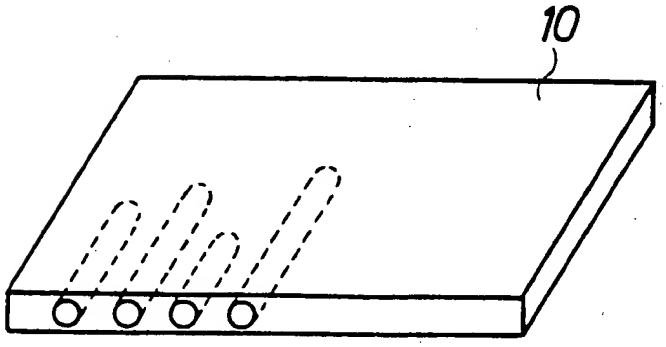

FIG. 8

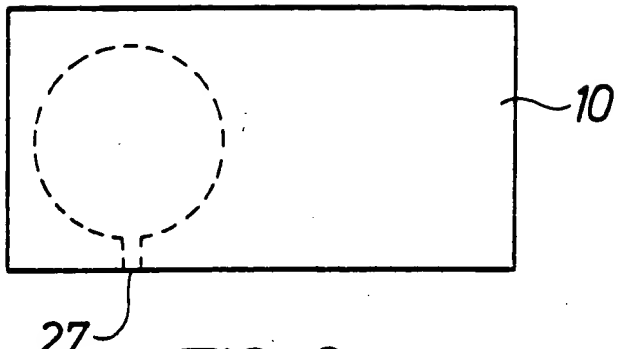

FIG. 9

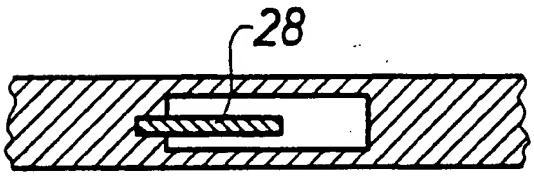

FIG. 10

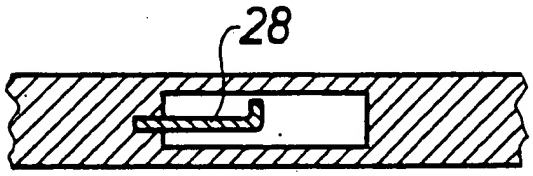

FIG. 11

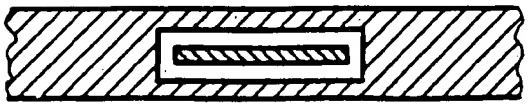

FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE94/00141

A. CLASSIFICATION OF SUBJECT MATTER

IPC : G07F 7/12, G06K 7/02, G07C 11/00, G01S 17/74
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, CLAIMS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	figures 1-6, claims 15-18	1-18
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Y	WO, A1, 9220048 (ELYSIUM AKTIEBOLAG), 12 November 1992 (12.11.92), page 6, line 16 - page 7, line 10, figure 1, abstract	1-18
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
21 June 1994	22 -06- 1994
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 94/00141

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL CH REPORT
Information on pate ly members

28/05/94

Internat[redacted]application No.
PCT/SE 94/00141

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